Description

AN ADJUSTABLE CRIMPING TOOL

Technical Field

[01] This invention relates to a device for crimping a workpiece, and, more particularly, to a crimping tool for providing a pre-determined crimped diameter of the workpiece.

Background

[02] Crimping machines generally comprise a press, a die, and a die bowl, and are used in applications where an evenly distributed circumferential force is applied to a workpiece to reduce the workpiece's diameter by plastically deforming the radial circumference, such as, attaching a coupling to a hose.

[03] The die is made with a plurality of die fingers radially disposed around the workpiece. Each finger having an inside surface adjacent of the workpiece and formed to define the workpiece's crimped shape. The die's outer surface is tapered and substantially matches the inside surface of the die bowl. The press comprises a ram to push the die through the die bowl, wherein a camming action of the matching surfaces forces the die inward, thus crimping the workpiece evenly around the circumference.

[04] The extent to which the workpiece is crimped is relative to the insertion of the die in the die bowl. To control the insertion, prior art controls the stroke of the press either by adjusting the maximum stroke of the press or by the operator stopping the press at the right depth. This does not allow for consistence die insertion since the insertion is a function of the stroke of the press and not a function of the depth of the die relative to the die bowl.

[05] In order to crimp a variety of workpieces, such as various diameter hoses and different shaped and sized couplings, prior art machines use assortments of dies and die bowls. Having multiple dies and die bowls increases the likelihood that one might be lost or misplaced. For portable machines, it is also important that the crimping machine be adaptive and provides flexibility in the field.

[06] One known crimping apparatus is disclosed in U.S. Patent 4,071,936, issued Feb. 7, 1978, to John Lionel Smith. It discloses a crimping apparatus wherein the variation of the camming surfaces is provided by threadably mounting the crimping ring (die bowl) to the chamber of a hydraulic pump, thus, rigidly mounting the crimping ring to the hydraulic pump.

[07] The present invention is directed to overcoming one or more of the problems set forth above.

Summary of the Invention

[08] In accordance with an embodiment shown, a crimping tool used with a crimping apparatus includes a first member having a die receiving portion, a second member being connectable with the first member, and wherein the crimping tool is removably coupled with the crimping apparatus.

[09] In accordance with another embodiment, a crimping apparatus having a die assembly includes a frame member, a pressure applying device coupled to the frame member, and a crimping tool removably coupled to the frame member, where the crimping tool has a first and second member.

Brief Description of the Drawings

[10] Fig. 1 is a drawing of an embodiment of an crimping tool of the present invention.

[11] Fig. 2 is a cross-sectional drawing of an embodiment of a crimping tool of the present invention.

[12] Fig. 3 is a graphical representation of an embodiment of a crimping system of the present invention

Detailed Description

[13] Fig.1 depicts a crimping tool 100 for use with a crimping apparatus 300 (shown in Fig. 3), having a first member 102 and a second member 104.

[14] The second member 104 is adjustably connected to the first member 102 and is positionable to adjust the height of the crimping tool 100. Indicia 106 are provided to show the amount of adjustment through coarse adjustment indicia 108 and fine adjustment indicia 110, as described hereinafter.

[15] The second member 104 has a graspable surface 112, such as knurling, wrench flats, tacky surface, or knobs to index the second member 104 relative to the first member 102. In the embodiment shown the graspable surface 112 is a knurled surface around the circumference and disposed partially down the outer periphery from the top surface 116 of the second member 104.

[16] The fine adjustment indicia 110 are shown in the embodiment as a reference mark 118 and an annular scale 120. The reference mark 118, shown in the embodiment as a line, is marked on the outer periphery of the first member 102. Alternatively, the reference mark could be a carrot mark, arrow, indentation, hole, or any other means of making a reference mark.

[17] The annular scale 120, which is disposed around the outer periphery of the second member 104, includes graduations 124 at predetermined intervals extending from adjacent the bottom surface 122 partially towards the top surface 116 of the second member 104 and in the axial direction of the second member 104. As the second member 104 is rotated around the first member 102 the graduations 124 align to the reference line 118. Each graduation 124 is scribed with a corresponding numerical value. For exemplary purpose, the graduations 124 are scribed in .05 increments with a range of 0 to 1.00.

[18] In the embodiment shown, the coarse adjustment indicia 108 are that of a linear scale 126. The linear scale 126 is marked on the outer periphery of the first member 102. The linear scale 126, having graduations 128 at predetermined intervals, extends in the axial direction of the first member 102 and adjacent the reference mark 118. The first graduation 130, showing the minimum height of the crimping tool 100, aligns with the bottom surface 122 of the second member 104 when abutment is made between the top face 132 of the first member 102 and abutment surface 134 of the second member 104.

[19] Fig. 2 shows a cross-sectional view of the crimping tool 100 and includes a die assembly 212. For exemplary purposes, Fig. 2 further shows a die biasing member 214 and a retaining member 216 in a cooperative arrangement to support and position the die assembly 212 in relation to the first member 102. The die biasing member 214 and retaining member 216 are illustrated in the embodiment as a spring and snap ring, respectively, but could be any known arrangement that would support and eject the die assembly 212 after a crimping operation. The die biasing member 214 includes a support member 219, having a top surface 221 that abuts with the die assembly's bottom surface 223 and rests on the spring. The first member 102 includes a stepped counterbore 218 from adjacent the bottom surface 224 of the first member 102 and extending partially in the axial direction towards the top face 132 of the first member 102. The partially extending stepped counterbore 218 steps radially inwardly forming a counterbore face 225. A tapered bore 236 outwardly tapers from adjacent the counterbore face 225 to adjacent the top face 132 of the first member 102. The counterbore face 225 provides an abutment for the die biasing member 214. Intermediate of the counterbore 218 a groove 222 is formed to accept the retaining member 216. The die biasing member 214 is held in relation to the first member 102 by the retaining member 216 and the counterbore face 225.

[20] The crimping tool 100 includes an adjustment mechanism 202, such as threads, detents, cylinder, or automatic methods, for variably adjusting

the height of the crimping tool 100. In the embodiment shown, the second member 104 is threadably attached to the first member 102 by the internal threads 204 of the second member 104 rotatably engaging the external threads 206 of the first member 102. Alternatively, the first and second member 102,104 could have a thread pattern opposing the aforementioned.

[21] The die assembly 212 includes a plurality of die fingers 226 equally spaced in a circumferential manner around the workpiece. The individual die fingers 226 are separated and retained by a unitary retention band 230. Each die finger 226 has an inner forming surface 232, defining the workpiece's crimped form, and an outer camming surface 234, which is tapered to substantially match the tapered bore 236 of the first member 102 to position the die assembly 212 in the first member 102.

[22] Fig. 3 shows the crimping apparatus 300, which includes a frame 302, a pressure applying device 304 coupled to the frame 302, the crimping tool 100, and die assembly 212. In the embodiment shown the crimping apparatus 300 is that of a portable type. Alternatively, any crimping apparatus 300, such as benchtop type, or production press that includes the aforementioned elements could be used. The pressure applying device 304 shown is a hydraulic cylinder type, but alternatively a pneumatic press, electric press, screw press, lever press, or any suitable pressure applying device could be used. The crimping apparatus 300 includes a bottom plate 306 structured to accept the crimping tool 100. The bottom surface 224 of the first member 102 is removably coupled to the bottom plate's 306 pressing surface 310 and positioned to axially align with the pressure applying device 304.

[23] The pressure applying device 304 includes a ram 312 attached to the rod end 314 of a rod 316 of the pressure applying device 304. A ram bore 318 defines a center cavity of the ram 312 and creates a aperture 320 in the ram face 322. The ram face 322 is generally parallel to the top surface 116 of the second member 104 and substantially overlaps the second member 104 and die

assembly 212 top surfaces 116,324, as not to interfere with workpieces (not shown) protruding out of the die assembly 212.

Industrial Applicability

[24] The present invention is intended to provide a crimping tool 100 used within a crimping apparatus 300 for crimping a workpiece (not shown), such as, crimping a coupling to a hose.

[25] The die assembly 212 is positioned in the crimping tool 100 by matching the camming surface 234 of the die assembly 212 and the tapered bore 236 of the first member 102. The bottom surface 223 of the die assembly 212 rests on the top surface 221 of the support member 219 of the die biasing member 214. A workpiece is placed in the center of the die assembly 212, adjacent the inner forming surface 232 of the die fingers 226.

[26] The pressure applying device 304 uses a ram 312 to apply pressure to the top surface 324 of the die assembly 212. As the ram 312 pushes the die assembly 212 into the first member 102, the camming surface 234 and the tapered bore 236 forces the die fingers 226 inward, in turn, collapsing the space provided by the unitary retention band 230. The die fingers 226 apply equal compression around the circumferentially outer surface of the workpiece, which reduces the diameter of the workpiece. The positive movement of the die assembly 212 in the crimping tool 100 determines the crimped diameter of the workpiece. Positive movement of the die assembly 212 is stopped when the ram face 322 abuts the top surface 116 of the second member 104. The height of the crimping tool 100, which is the relationship between the second member 104 and the first member 102, pre-determines the crimped diameter of the workpiece. The embodiment shown allows the crimped diameter to be consistent, regardless of the type of pressure applying device 304 and stroke of the ram 312.

[27] To vary the height of the crimping tool 100, the second member 104 is threaded onto the first member 102. By rotating the second member 104 clockwise or counter-clockwise the height of the crimping tool 100 decreases or

increases, depending on the orientation of the threads. By reading the coarse adjustment indicia 108 and the fine adjustment indicia 110, an operator can set an applicable height of the crimping tool 100. The embodiment, as described herein, allows the crimping tool 100 to be adaptable to multiple die assemblies 212, in turn, reducing the number of pieces needed to complete a wide range of jobs.

[28] Upon the release of the pressure being applied to the die assembly 212, the die biasing member 214, which is applying a responsive force, pushes the die assembly 212 out of the crimped position. In turn, freeing the workpiece to be removed.

[29] Other aspects, objects and advantages of this invention can be obtained from a study of the drawings, the disclosure, and the appended claims.